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HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN NO. 47.

ON FIELD EXPERIMENTS WITH TOBACCO IN MASSACHUSETTS.

- I. GENERAL DISCUSSION OF EXPERIMENTS.
- II. EXPERIMENTS AT HATFIELD, MASS.
- III. EXPERIMENTS AT AGAWAM, MASS.
- IV. EXPERIMENTS AT WESTFIELD, MASS.
- V. SUMMARY OF THREE YEARS OBSERVATIONS AT HATFIELD,
AGAWAM AND WESTFIELD, 1893—1896.

APRIL, 1897.

The Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same.

AMHERST, MASS.:
PRESS OF CARPENTER & MOREHOUSE,
1897.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

By act of the General Court, the Hatch Experiment Station and the State Experiment Station have been consolidated under the name of the Hatch Experiment Station of the Massachusetts Agricultural College. Several new divisions have been created and the scope of others has been enlarged. To the horticultural, has been added the duty of testing varieties of vegetables and seeds. The chemical has been divided, and a new division, "Foods and Feeding," has been established. The botanical, including plant physiology and disease, has been restored after temporary suspension.

The officers are :—

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GEORGE E. STONE, PH. D.,	<i>Botanist.</i>
CHARLES A. GOESSMANN, PH. D., LL. D.,	<i>Chemist (Fertilizers).</i>
JOSEPH B. LINDSEY, PH. D.,	<i>Chemist (Foods and Feeding).</i>
CHARLES H. FERNALD, PH. D.,	<i>Entomologist.</i>
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ROBERT H. SMITH, B. SC.,	<i>Assistant Chemist (Fertilizers).</i>
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BENJAMIN K. JONES, B. SC.,	<i>Assistant in Foods and Feeding.</i>
JAMES L. BARTLETT,	<i>Observer.</i>

The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

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REPORT

On Field Experiments With Tobacco in Massachusetts, 1893—1896.

BY

CHARLES A. GOESSMANN.

I. GENERAL INTRODUCTION.

The experiments described in the following pages were carried on with the coöperation of the Valley Tobacco Experiment Association of Massachusetts. This organization of prominent cultivators of tobacco in the Connecticut River Valley was formed at a public meeting of parties interested in tobacco culture. The meeting was called February 4, 1893, at Northampton, at the suggestion of the writer by W. A. Porter of Agawam, a member of the Board of Control of the Massachusetts Experiment Station.

The officers chosen on that occasion were President, L. A. Crafts of Whately; Vice-President, C. L. Fowler of Westfield; Secretary and Treasurer, G. D. Fisk of Agawam; Board of Directors, W. A. Porter of Agawam and C. L. Warner of Hatfield.

After a general discussion of the object of the meeting the following plan of operation was decided upon:

1. To select suitable lands in different parts of the valley to secure as far as practicable diversity of soil and local climatical conditions. Hatfield, Westfield and Agawam were chosen for the location of the experiments. The selection of the particular field in each place was left to a special committee of the Association. In all cases a deep sandy loam was selected for the trial.

2. To use in each case the same kind and the same amount of fertilizing ingredients, and to continue the observation for three

successive years before publishing the results obtained, in connection with suitable conclusions.

3. To place the entire practical management of soil and of crop, before and after harvesting, in the hands of experienced tobacco growers, the owners of the fields engaged in the trial. A committee of officers of the Association was to visit at stated times the different localities, to report on the condition and the character of the crop raised.

4. To assign to the writer as acting Director of the Massachusetts Agricultural Experiment Station the business of securing and compounding the fertilizers to be used upon the different experiment plats; to measure the plats and to make subsequently a chemical analysis of the crops raised.

The observations in Hatfield by C. L. Warner & Bro., and in Agawam by Geo. D. Fisk began during the spring of 1893, while those in Westfield by C. F. Fowler were deferred until the spring of 1894. They were each continued for three years in succession. Each experiment plat occupied an area of one-twelfth of one acre with from three to four feet of unoccupied space between adjoining plats. The variety of tobacco selected for the trial was Havana Seed. For the purpose of securing uniformity of fertilizer during the years of the experiment, it was decided to purchase at once as far as advisable enough of each kind to supply the needed materials for three years.

Statement of Fertilizers used upon different Plats.

The fertilizer mixture used during the entire time of observation contained in all cases, per acre,

Potassium oxide, (available)	300 pounds.
Nitrogen, (available)	100 pounds.
Phosphoric acid, (available)	60 pounds.

One-fourth of the nitrogen was in all cases used in the form of nitrates of soda or potash, to secure a uniform condition of availability of nitrogen during the early stage of growth.

Chemical composition of different fertilizing ingredients used in compounding the special fertilizers for different plats.—Ingredients containing chlorine were carefully excluded from the mixtures of fertilizers in all cases.

Name of material.	Nitrogen.	Phosphoric acid.	Potassium Oxide	Sodium Oxide.	Calcium Oxide.	Magnesium Oxide.
Nitrate of Soda,	15.59	—	—	35.00	—	—
Nitrate of Potash,	12.79	—	45.05	—	—	—
Cotton Seed Meal,	6.50	3.17	2.25	—	*	*
Linseed Meal,	5.91	1.95	1.08	—	*	*
Castor Pomace,	5.60	2.26	3.40	—	*	*
Dissolved Bone-black,	—	13.38	—	—	*	—
Oderless Phosphate, i. e. }	—	18.42	—	—	48.27	—
Phosphatic Slag meal, }	—	—	—	—	—	—
High Grade Sulphate of Potash,	—	—	50.20	—	—	—
Potash-Magnesia Sulphate,	—	—	24.32	—	—	12.58
Cotton Seed Hull Ashes,	—	7.93	23.96	—	9.30	10.47
Carbonate of Potash-Magnesia,	—	—	18.48	—	—	19.52
Barnyard Manure,	0.52	0.39	0.56	—	*	*

*Not determined.

Preparation of Fertilizers.

The special fertilizer mixtures used in the case of the different plats were prepared from the above stated materials at the Mass. Experiment Station at Amherst, Mass.

They were selected in each case, as far as desired with reference to *different forms* of potash, of nitrogen and of phosphoric acid to study their influence on quantity and in particular on the quality of the tobacco crop raised under otherwise fairly corresponding conditions.

PLAT 1.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium Oxide.	Nitrogen.
Nitrate of Potash,	195.	—	88.	25.
Cotton Seed Meal,	1154.	37.	26.	75.
Dissolved Bone-black,	175.	23.	—	—
Potash-Magnesia Sulphate,	765.	—	186.	—
Total,		60.	300.	100.

PLAT 2.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Potash,	195.	—	88.	25.
Castor Pomace,	1340.	31.	45.	75.
Dissolved Bone-black,	221.	29.	—	—
Potash-Magnesia Sulphate,	685.	—	166.5	—
Total,		60.	299.5	100.

PLAT 3.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Soda,	160.3	—	—	25.
Cotton Seed Meal,	1154.	37.	26.	75.
Cotton Seed Hull Ashes,	1142.	90.56	274.	—
Total,		127.56	300.	100.

PLAT 4.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Soda,	160.3	—	—	25.
Castor Pomace,	1340.	31.	45.50	75.
Cotton Seed Hull Ashes,	1060.	84.1	253.97	—
Total,		115.1	299.47	100.

PLAT 5.

No manure at any time during the experiment.

PLAT 6.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Soda,	160.3	—	—	25.
Cotton Seed Meal,	1154.	37.	26.	75.
Dissolved Bone-black,	175.	23.	—	—
High Grade Sulphate of Potash,	545.8	—	274.	—
Total,		60.	300.	100.

PLAT 7.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Soda,	160.3	—	—	25.
Castor Pomace,	1340.	31.	45.50	75.
Dissolved Bone-black,	221.	29.	—	—
High Grade Sulphate of Potash,	506.	—	254.50	—
Total,		60.	300.	100.

PLAT 8.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Soda,	160.3	—	—	25.
Linseed Meal,	1271.	24.78	14.	75.
Dissolved Bone-black,	263.	35.22	—	—
High Grade Sulphate of Potash,	569.7	—	286.	—
Total,		60.	300.	100.

PLAT 9.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Potash,	195.	—	88.	25.
Cotton Seed Meal,	1154.	37.	26.	75.
Cotton Seed Hull Ashes,	776.	62.	186.	—
Total,		99.	300.	100.

PLAT 10.

Name of fertilizing material used.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Nitrate of Potash,	195.	—	88.	25.
Castor Pomace,	1340.	31.	45.50	75.
Phosphatic Slag Meal,	157.	29.	—	—
Carbonate of Potash-Magnesia,	900.9	—	166.50	—
Total,		60.	300.	100.

PLATS 11 and 12.

Name of fertilizing material used. Average analysis of seventy-five samples tested at the station laboratory at Amherst, Mass.	Pounds per acre.	Pounds of fertilizing elements per acre.		
		Phosphoric acid.	Potassium oxide.	Nitrogen.
Barnyard Manure,	20,000	78.0	112.0	104.0

Barnyard manure was added in several localities to the list of fertilizers on trial during the second year. It was slightly ploughed under during the preceding autumn to secure a suitable disintegration. Cost of fertilizer per acre when bought 1893 :

Plat 1,	\$36.70	Plat 7,	\$29.30
Plat 2,	33.70	Plat 8,	37.20
Plat 3,	42.40	Plat 9,	38.30
Plat 4,	38.70	Plat 10,	35.90
Plat 5,	nothing.	Plat 11,	at local cost.
Plat 6,	32.30		

Average cost, (per acre), \$36.10

Cost of materials in 1893, per ton of 2000 pounds, including freight at Amherst, Massachusetts :

Castor Pomace,	\$23.40
Cotton Seed Meal,	31.00
Linseed Meal,	34.80
Nitrate of Potash,	87.40
Nitrate of Soda,	49.40
Cotton Seed Hull Ashes,	50.40
High Grade Sulphate of Potash,	52.40
Sulphate of Potash-Magnesia,	40.40
Carbonate of Potash-Magnesia,	39.10
Dissolved Bone-black,	24.20
Phosphatic Slag Meal,	19.00
Barnyard Manure,	at local cost.

A comparison of the cost of most fertilizing ingredients above stated with that charged at the present time averages approximately 25 % less—in favor of the present year.

The statements of actual yield of tobacco per plat is in all cases supplemented by a statement of yield of tobacco for one thousand plants actually harvested to exclude such varying incidental influences as cutworm, etc., from affecting the conclusions drawn from the results.

II. EXPERIMENTS ON THE FARM OF C. S. WARNER AT HATFIELD, MASS.

1893—1894—1895.

1893. First year. The field selected for the observation covered an area of three hundred and twenty-four feet in length and one hundred and thirty feet in width. It was located along a highway in the middle of a district almost exclusively devoted to the raising of tobacco. The field was divided into two plats of equal length and width, leaving four feet of unoccupied space between them. Each of these plats was again divided into five parallel running plats of equal size and shape, with three feet of space between adjoining plats, making ten plats in all; each of these plats measured three thousand six hundred and thirty-four square feet, or approximately one-twelfth of one acre. At the close of the month of April, after a careful mechanical preparation of the soil, each plat received one of the above stated mixed fertilizers, strewn broadcast, and well ploughed under before planting. The setting of tobacco plants took place on the same day, May 7th, seven rows of plants, three feet apart, in each plat, with plants two feet from each other in the row. The dryness of the season and ravages of cutworms necessitated here and there resetting of the plants. The field when visited by the writer July 8th, '93, was found in good condition, and compared favorably with surrounding tobacco fields.

The following table gives the number of plants harvested in 1893:

Plat 1,	546 plants.	Plat 6,	526 plants.
Plat 2,	554 plants.	Plat 7,	546 plants.
Plat 3,	570 plants.	Plat 8,	567 plants.
Plat 4,	577 plants.	Plat 9,	568 plants.
Plat 5,	591 plants.	Plat 10,	567 plants.

The average number of plants, per plat, set was 585.6, the average number of plants harvested per plat was 561.2; the average number of plants missing was 4.4%.

The plants were cut and housed August 10th and stripped October 13th. The crop was inspected December 25th by the appointed committee, Messrs. W. A. Porter and Geo. D. Fisk of Agawam, L. A. Crafts of Whately and C. L. Warner of Hatfield.

REPORT OF COMMITTEE ON CROP 1893.

Rank of Plats.

1. Texture, color, vein. Plats 9, 10, 7, 8, 6, 4, 2, 1, 3, and 5.
2. Total weight per plat. Plats 1, 4, 9, 10, 2, 7, 8, 3, 5, and 6.
3. Weight and percentage of wrapper, Plats 10, 9, 4, 2, 6, 8, 7, 3, 1 and 5.
4. Burning quality; only one test was made by committee and results were not considered reliable. The test was referred to the laboratory of the Experiment Station. See succeeding statements.

Plats.	Tobacco pounds.	Plats.	Wrapper pounds.	Wrapper per cent.
1	145	10	96	71.63
4	139	9	87	60.40
9	134	4	76	54.80
10	134	2	53	40.46
2	131	6	45	37.10
7	129	8	43	33.33
8	129	7	42	32.56
3	129	3	42	32.56
5	128	1	41	28.28
6	121	5	27	21 10

After sweating, the tobacco grown on plats 9 and 10 was considered best; that grown on Plats 2, 4, 6, and 8 were marked good; that on Plats 1, 3, and 7 medium while that grown on Plat 5 was dark in color and below medium.

LABORATORY TEST ON FIRE HOLDING CAPACITY.

This was determined in the air dried leaves by bringing the leaf, held in a horizontal position, in contact with a lighted slow-match, and noting the number of seconds elapsing between the instant of contact and the dying out of the last trace of fire in the leaf. Five leaves were selected from each lot and six tests were made on each leaf, three on each side of the midrib, one near the tip, one near the middle and the third near the base of the leaf. Thus it is apparent that the figures stated below represent the average of thirty determinations.

HATFIELD.

According to plats.		According to plats.	
Plat.	Seconds.	Plat.	Seconds.
1	12	6	8
2	4	7	15
3	11	8	13
4	8	9	5
5	6	10	15

QUALITY OF ASH.

The relative burning quality of the wrappers of the different plats was determined by wrapping small cigars (Blackstone Juniors) with sections of the leaves, and smoking them by means of an aspirator. Three determinations were made on each plat, all of the cigars being preserved until the close of the operation, and the comparison of ash being made by a careful examination and arrangement according to quality.

The results are given below :

Rank of Plat: 9, 10, 4, 5, 3, 1, 6, 2, 8, 7.

Second year at Hatfield. 1894. The field, the general arrangement of the plats and the different fertilizers used upon the plats were the same as in the preceding year. The preparation of the soil was also the same.

Two new plats of corresponding size and shape running along the west side of the entire field were added to compare the effect of an average barn-yard manure with that of chemicals and chemical fertilizers on the quality and quantity of the tobacco raised. Eight rows of plants were set in each plat two feet and eight inches apart, instead of seven rows three feet apart as in 1893; the plants were two feet apart, as before, in the row. The setting of all of the plats took place May the 18th. The plants were topped July the 18th with the exception of those upon the unfertilized plat (5) which was deferred until July 22nd. The crop was cut and housed August 10th.

Number of plants in plats when harvested.

Plat 1,	647	Plat 7,	641
Plat 2.	647	Plat 8,	638
Plat 3,	646	Plat 9,	600
Plat 4,	588	Plat 10,	592
Plat 5,	603	Plat 11,	579
Plat 6,	639	Plat 12,	604

REPORT OF COMMITTEE ON CROP (1894).

Rank of Plats.

1. Texture, color, vein, Plats 3, 8, 10, 7, 4, 12, 11, 9, 6, 5, 2, and 1.
2. Total weight of tobacco, Plats 11, 8, 3, 12, 2, 10, 7, 9, 1, 5, 6, 4.
3. Percentage of wrapper, Plats 8, 9, 3, 10, 11, 6, 5, 12, 7, 2, 4, 1.

ACTUAL YIELD PER PLAT.

Plats.	Tobacco pounds.	Plats.	Wrapper pounds.	Wrappers per cent.
11	140	8	87	64.40
8	135	3	79	58.51
3	135	9	76	59.38
12	135	11	74	52.86
2	134	10	70	53.02
10	132	12	64	47.40
7	132	5	63	50.80
9	128	6	63	51.64
1	126	7	61	46.21
5	124	2	59	44.03
6	122	1	49	38.89
4	119	4	48	40.35

QUALITY OF ASH AND FIRE HOLDING CAPACITY.

Quality of Ash.	Fire holding capacity.	
	According to plats.	
	Plat.	Seconds.
4	1	6
10	2	6
3	3	45
11	4	40
8	5	17
12	6	8
9	7	11
1	8	19
2	9	10
5	10	36
7	11	59
6	12	9

Third year at Hatfield, (1895.) The same field, the same arrangement of plats and the same kinds of fertilizers were used as in the preceding year. The tobacco was set May 28th, topped July 3rd, cut and housed July 29th. The tobacco was stripped October 15th and 16th.

NUMBER OF PLANTS HARVESTED PER PLAT.

Plats.	Number of plants.	Plats.	Number of plants.
1	630	7	603
2	630	8	604
3	645	9	625
4	686	10	620
5	610	11	640
6	612	12	625

Report of Committee on Crop, (1895.)

Rank of Plats.

Texture, color, vein. Plats 9, 11, 4, 3, 10, 8, 7, 6, 2, 1, 5.

Total weight of tobacco. Plats 11, 3, 2, 6, 8, 9, 10, 1, 4, 7, 5.

Percentage of wrapper. Plats 9, 3, 4, 10, 6, 11, 7, 8, 5, 2, 1.

ACTUAL YIELD PER PLAT.

Plats.	Tobacco pounds.	Plats.	Wrapper pounds.	Wrappers per cent.
11	142	9	84	63.06
2	135	3	83	61.50
3	135	4	78	59.60
6	134	10	77	57.89
8	134	11	76	53.52
9	133	6	76	56.71
10	133	8	68	50.74
1	133	7	66	52.38
4	131	2	54	40.00
7	126	5	53	42.74
5	124	1	49	36.84

QUALITY OF ASH AND FIRE HOLDING CAPACITY. HATFIELD, 1895.

Laboratory Tests.

Quality of Ash.	Fire holding capacity.	
	According to plats.	
Plats.	Plats.	Seconds.
4	1	37
3	2	41
9	3	393
10	4	773
7	5	31
6	6	22
12	7	25
5	8	20
8	9	1469
11	10	82
2	11	123
1	12	14

The test for the quality of the ash was made in the above case with small cigars made from the product of each plat. The results with two or three exceptions—1, 2, 11,—were very satisfactory, the ash being of a uniform light shade and compact.

ANALYSIS OF TOBACCO. HATFIELD. THIRD YEAR, 1895.

(Whole Leaf.)

No. of Plats.	1	2	3	4	5	6	7	8	9	10	11&12
Moisture,	12.71	12.48	11.16	12.08	18.50	12.48	12.05	11.65	12.00	12.95	11.61
Nitrogen,	2.63	2.35	2.27	2.54	2.15	2.14	2.62	2.81	1.54	2.68	2.50
Phosphoric acid	.48	.46	.43	.44	.31	.39	.53	.50	.36	.39	.46
Sulphuric acid,	2.29	2.23	1.53	1.75	1.53	2.04	2.28	1.72	1.13	1.51	1.70
Chlorine,	.07	.094	.02	.02	.02	.099	.17	.06	.08	.005	.198
Potass'm oxide,	6.78	6.93	6.89	6.95	5.93	7.46	6.81	7.17	7.11	6.59	6.58
Sodium oxide,	1.76	2.07	1.99	2.74	1.84	1.51	1.71	1.94	1.91	1.87	1.67
Calcium oxide,	4.08	4.30	4.80	4.72	4.65	4.73	3.48	4.35	4.82	3.50	4.43
Magnes'm oxide	.79	1.47	1.71	1.51	1.35	.74	.45	1.85	1.53	1.32	.97
Iron & Al. oxide	.55	.60	.75	.45	.35	.60	.50	.45	.82	.50	.60
Total ash as sulphates,	27.02	30.00	32.28	33.75	27.75	32.55	28.32	28.70	36.72	28.70	30.45
Sulphuric acid in ash less sulphuric acid in plants,	10.51	12.02	11.90	14.66	11.66	11.55	11.04	12.39	15.35	12.53	12.65
Silicious material insoluble in diluted hydrochloric acid,	3.43	4.65	5.61	2.58	2.38	3.76	3.69	2.38	5.32	2.66	3.78

H. D. HASKINS, Analyst.

The determination of total ash was made in form of sulphates instead of carbonates to secure more reliable figures for comparing results.

SUMMARY OF TOBACCO EXPERIMENT. HATFIELD.

Number of plants harvested and weight of tobacco.

	Number of plants harvested per plat.			Weight of tobacco per plat. (lbs.)			Weight of tobacco per 1000 plants harv'd. lbs.		
	1893	1894	1895	1893	1894	1895	1893	1894	1895
Plat 1,	546	647	630	145	126	133	266	195	211
Plat 2,	554	647	630	131	134	135	236	207	214
Plat 3,	570	646	645	129	135	135	226	209	209
Plat 4,	577	588	686	139	119	131	241	202	191
Plat 5,	591	603	610	128	124	124	217	206	203
Plat 6,	526	639	612	121	122	134	230	191	218
Plat 7,	546	641	603	129	132	126	236	206	209
Plat 8,	567	638	604	129	135	134	228	212	222
Plat 9,	568	600	625	134	128	133	236	213	213
Plat 10,	567	592	620	134	132	133	236	223	211
Plat 11,	—	579	640	—	140	142	—	242	222
Plat 12,	—	604	625	—	135	—	—	223	—

SUMMARY OF YIELD OF TOBACCO AND OF PER CENT OF WRAPPER PER ONE THOUSAND PLANTS. HATFIELD.

Per 1000 plants.	Tobacco total yield. (lbs.)			Amount of wrapper. (lbs.)			Per cent of wrapper.		
	1893	1894	1895	1893	1894	1895	1893	1894	1895
Plat 1,	266	195	211	75.1	75.9	77.66	28.23	38.88	36.80
Plat 2,	236	207	214	95.5	91.1	85.60	40.50	44.02	40.00
Plat 3,	226	209	209	73.6	122.3	128.40	32.56	58.50	61.43
Plat 4,	241	202	191	132.	81.3	113.70	54.80	40.24	59.50
Plat 5,	217	206	203	45.8	104.7	87.00	21.20	50.82	42.85
Plat 6,	230	191	218	85.6	98.6	123.60	37.20	51.64	56.70
Plat 7,	236	206	209	76.8	95.2	109.10	32.54	46.21	52.20
Plat 8,	228	212	222	76.0	136.6	112.10	33.33	64.43	50.50
Plat 9,	236	213	213	142.6	126.4	134.50	60.42	59.34	63.14
Plat 10,	236	223	211	169.0	118.1	122.00	71.64	53.02	57.82
Plat 11,	—	242	222	—	127.1	119.00	—	52.50	53.60
Plat 12,	—	223	232	—	105.7	—	—	47.40	—

III. EXPERIMENTS AT AGAWAM, ON THE FARM OF GEO. D. FISK.

1893—1894—1895.

The field used for the experiment covered an area of 41,419 square feet, being four hundred and twenty-seven feet long and ninety-seven feet wide. The land had served in preceding years for the

production of general farm crops and had never been used for the cultivation of tobacco. It was divided by means of an unoccupied space, four feet in width, running through the center of the field, into two parts of equal length and width. Each of these parts was subsequently sub-divided into five plats, making ten plats in all.

The ten plats were of equal size and shape with an unoccupied space of three feet in width separating adjoining plats. Each plat measured three thousand six hundred and twenty-nine and one-half square feet, equal, approximately to one-twelfth of one acre. They received the same kind and the same amount of fertilizer as the plats at Hatfield. The fertilizers were applied broadcast and were well harrowed in at the close of the month of April.

First Year (1893.) After a careful mechanical preparation of the soil, the plants were set out June 13th and 14th. Each plat contained five rows three feet apart with plants eighteen inches from each other in the row. Dry weather and the work of the cutworm necessitated a resetting of plants in many instances. At the time of the first hoeing, June 28th, the crop looked well as far as color was concerned, but suffered much subsequently from dry weather in July and August and also from two severe wind storms during the latter month.

The general appearance of the field at the close of the season however compared well with other tobacco fields in the vicinity. The tobacco was harvested September 11th and 12th. It cured well with a light color.

NUMBER OF PLANTS HARVESTED.

Plat 1,	701	Plat 6,	668
Plat 2,	695	Plat 7,	682
Plat 3,	701	Plat 8,	695
Plat 4,	701	Plat 9,	705
Plat 5,	722	Plant 10,	690

REPORT OF COMMITTEE ON CROP 1893.

Rank of Plats.

Texture, color, vein, Plats 4, 2, 8, 1, 3, 9, 7, 6, 10, 5.

Weight of tobacco, Plats 7, 4, 2, 10, 3, 8, 1, 6, 9, 5.

Percentage of wrappers, Plats 1, 2, 5, 3, 4, 7, 10, 8, 9, 6.

ACTUAL YIELD OF PLATS.

Plats.	Weight of tobacco. (lbs.)	Percentage of wrappers. (lbs.)
7	153.5	9.12
4	151.5	11.88
2	142.5	25.96
10	139.	9.
3	134.	18.66
8	134.	8.58
1	127.	37.79
6	117.5	6.80
9	115.5	9.91
5	114.	24.56

QUALITY OF ASH AND FIRE HOLDING CAPACITY. FIRST YEAR.

Quality of Ash.	Fire holding capacity.	
	According to plats.	
Plats.	Plat.	Seconds.
2	1	8
6	2	53
9	3	10
10	4	72
5	5	27
4	6	44
3	7	12
8	8	15
1	9	18
7	10	52

The results of the experiment showed in many ways the adverse influence of an unfavorable season.

Second year, (1894.) The field, the arrangement of the plats and the application of the fertilizers used, were the same as in the preceding year. One plat was added to the list to compare the effect of barnyard manure, under otherwise fairly corresponding conditions with that of the various mixtures of chemicals and commercial fertilizing materials used upon the other plats. The new plat (Plat 11) received 1640 pounds of barnyard manure per plat or ten tons per acre.

The tobacco plants were set out June 5th upon plats 1, 10, 2, 9, 3, 8, and part of 4 and 7; the remainder were set June 7th and 8th.

The growth of plants was on the whole very satisfactory and but few plants were missing and the crop when harvested, September 7th

and 8th, in the opinion of Mr. Fisk was much better than the crop raised during the preceding year and compared very favorably with the crops of tobacco-fields in this vicinity.

NUMBER OF PLANTS HARVESTED.

Plat 1,	697	Plat 7,	686
Plat 2,	695	Plat 8,	707
Plat 3,	708	Plat 9,	722
Plat 4,	706	Plat 10,	699
Plat 5,	706	Plat 11,	692
Plat 6,	710.		

REPORT OF COMMITTEE ON CROP OF 1894.

Rank of Plats.

Texture, color, vein, Plats 9, 8, 7, 10, 6, 4, 3, 2, 5, 1, 11.

Weight of tobacco, Plats 9, 7, 4, 3, 8, 2, 10, 1, 5, 6, 11.

Percentage of wrappers, Plats 9, 8, 7, 10, 6, 4, 3, 1, 2, 5, 11.

ACTUAL YIELD OF PLATS.

Plats.	Weight of tobacco.	Weight of wrappers.	Percentage of wrappers.
9	156.5	69.5	44.56
7	151.	57.	37.75
4	148.	32.	21.62
3	148.	28.	19.05
8	145.	57.	39.31
2	134.	19.	14.18
10	123.	46.	37.40
1	120.	21.	17.50
5	114.	10.	8.77
6	112.	30.	26.83
11	78.5	3.5	4.46

QUALITY OF ASH AND FIRE HOLDING CAPACITY (SECOND YEAR, 1894.)

Quality of ash.		Fire holding capacity.	
		According to plats.	
		Plats.	Seconds.
	Plats.		
	3	1	4.
	9	2	5.
	4	3	10.5
	10	4	7.
	5	5	2.5
	8	6	5.
	7	7	4.3
	6	8	4.3
	2	9	3.8
	11	10	3.4
	1	11	4.

Third Year (1895.) The field, the general arrangement and management of the plats and the kind and amount of fertilizers were the same as in preceding years. The plants were set out during the last week in May. A considerable number of the plants had to be reset on account of the work of the cutworm and the imperfect work of the machine used in setting.

A hailstorm passed over the field July 13th, it did but little damage however on account of the small size of the plants. The crop was harvested rather late (September 10 and 12) on account of its maturing so slowly.

The number of plants per row averaged one hundred and thirty-nine, there being five rows in each plat.

NUMBER OF PLANTS HARVESTED.

There was on an average 695 plants in each plat; detailed record was lost.

REPORT OF COMMITTEE (1895.)

Rank of Plats.

Texture, color, vein, Plats 9, 4, 10, 3, 8, 11, 7, 2, 1, 6, 5.

Weight of tobacco, Plats 4, 8, 10, 1, 2, 3, 9, 7, 11, 6, 5.

Percentage of wrappers, Plats 11, 10, 9, 3, 4, 8.

ACTUAL YIELD OF PLATS. (POUNDS.)

Plats.	Weight of tobacco.	Weight of wrappers.	Percentage of wrappers.
4	154.5	2.5	1.61
8	145.5	.5	.34
10	136.5	8.0	5.86
1	135.5	—	—
2	130.	—	—
3	130.	4.0	3.07
9	129.	5.5	4.26
7	111.	—	—
11	104.5	11.	10.52
6	102.5	—	—
5	68.	—	—

QUALITY OF ASH AND FIRE HOLDING CAPACITY. AGAWAM. 1895.

Quality of ash.		Fire holding capacity.	
Plats.		Plats.	Seconds.
10		1	10
4		2	76
3		3	12
9		4	62
8		5	8
11		6	12
6		7	21
2		8	55
1		9	39
5		10	32
7		11	36

AGAWAM. ANALYSIS OF TOBACCO. 1895.

Whole Leaf.

Number of plat.	1	2	3	4	5	6	7	8	9	10	11
Moisture,	7.51	7.72	8.61	8.33	7.72	9.57	7.55	7.90	8.22	8.77	7.42
Nitrogen,	1.75	2.08	2.21	2.50	2.24	2.22	1.99	2.22	2.27	2.62	2.16
Phosphoric acid,	.38	.40	.33	.41	.55	.33	.27	.26	.34	.34	.35
Sulphuric acid,	1.85	2.44	1.30	1.46	1.73	2.28	2.08	1.89	1.24	1.01	1.87
Chlorine,	.84	.084	.101	.122	.406	.291	.06	.15	.099	.22	.54
Potass'm oxide,	5.62	5.36	5.80	6.13	2.00	6.48	6.30	6.80	5.54	5.28	5.43
Sodium oxide,	2.60	2.37	2.80	3.40	3.79	3.93	2.70	4.13	1.82	2.28	2.82
Calcium oxide,	4.92	3.52	3.78	3.68	3.43	4.03	4.68	4.68	3.78	3.17	4.02
Magnes'm oxide	1.36	1.74	2.07	1.70	1.49	1.08	1.18	1.30	1.94	2.37	1.33
Iron & Al. oxide	.93	1.00	.94	.59	.26	.39	.52	.55	.45	.45	.55
Total Ash as											
Sulphates,	33.29	36.04	33.38	31.06	25.43	29.40	30.92	29.70	28.90	27.37	26.37
Sulphuric acid											
in ash less											
sulphuric acid											
in plant,	12.97	11.64	14.41	13.25	10.09	12.03	12.10	10.56	12.53	12.73	10.70
Silicious material insoluble											
in diluted hydrochlor. acid	6.91	7.73	4.90	2.50	3.01	2.93	3.91	3.00	4.00	2.80	2.38

Total ash has been determined in form of sulphates instead of carbonates for reason stated.

H. D. HASKINS AND R. H. SMITH, Analysts.

SUMMARY OF TOBACCO EXPERIMENTS. AGAWAM.

Number of plants harvested and weight of tobacco per plat.

	Number of plants per plat.			Weight of tobacco per plat. (lbs.)			Weight of tobacco per 1000 plants. (lbs.)		
	1893	1894	1895	1893	1894	1895	1893	1894	1895
Plat 1,	701	697	39 plants in each row; five rows in each plat; average per plat 695 plants.	127	120	135.5	187.2	172.2	195
Plat 2,	695	695		142.5	134	130	203.6	193.0	187
Plat 3,	701	708		134	148	130	191.1	209	187
Plat 4,	701	706		151.5	148	154.5	214.7	208.6	222.3
Plat 5,	722	706		114	114	68	158	161.5	97.8
Plat 6,	668	710		117.5	112	102.5	176	157.8	148
Plat 7,	682	686		153.5	151	111	225.1	220.1	160
Plat 8,	695	707		134	145	145.5	192.8	205.1	209.3
Plat 9,	705	722		115.5	156.5	129	163.8	216.6	185.6
Plat 10,	690	699		139	123	136.5	201.5	176	196.4
Plat 11,	—	692			78.5	104.5	—	113.4	150.4

SUMMARY OF YIELD OF TOBACCO PER 1000 PLANTS AND OF PER CENT OF WRAPPER AGAWAM.

	Tobacco total yield (lbs.)			Wrapper total yield (lbs.)			Per cent of wrapper.		
	1893	1894	1895	1893	1894	1895	1893	1894	1895
Plat 1,	181.2	172.2	195.	Crop was sold in bulk.	30.1	—	—	17.5	—
Plat 2,	203.6	193.0	187.		27.4	—	—	14.2	—
Plat 3,	191.1	209.	187.		39.6	5.8	—	19.0	3.1
Plat 4,	214.7	208.6	222.3		45.1	3.6	—	21.62	1.6
Plat 5,	158.	161.5	97.8		14.2	—	—	8.8	—
Plat 6,	176.	157.8	148		42.3	—	—	26.8	—
Plat 7,	225.1	220.1	160.		83.1	—	—	37.8	—
Plat 8,	192.8	205.1	209.3		80.6	.72	—	39.3	.35
Plat 9,	163.8	216.6	185.6		96.2	8.0	—	44.4	4.3
Plat 10,	201.5	176.	196.4		66.0	11.5	—	37.5	5.8
Plat 11,		113.4	140.5		5.1	15.8	—	4.5	10.5

IV. EXPERIMENTS ON THE FARM OF C. F. FOWLER, WESTFIELD, MASS.,
1894—1895—1896.

The field engaged in the observations covers an area, four hundred and ten feet long and one hundred and one feet wide, which is divided in the center by a strip of unoccupied space five feet wide into two parts of equal size and shape, 205 by 101 feet. Each of these was subdivided into five plats; these parallel plats were separated from each other by an unoccupied space three feet in width. The ten plats thus obtained were of a uniform size and shape, each covering an area of three thousand six hundred and thirteen feet, or approximately one-twelfth of an acre. The soil is a light, sandy

loam, locally known by the name of light, sandy plain. The field is situated in the midst of a locality devoted largely to tobacco culture, but the field selected for our observations had never received any fertilizing material, with the exception of fifty bushels of leached ashes some ten years previous to 1894; for ten years past it had been cropped with corn and rye, but never with tobacco.

First Year (1894). The mechanical preparation of the soil and the kind of fertilizers used upon each plat, as well as the variety of tobacco selected and the general management of the crop during the season and after harvesting the tobacco, was materially the same as in the case of the experiments carried on at Hatfield and Agawam. The plats were laid out April 30, 1894; the fertilizers were harrowed in by an Acme harrow May 8th, and the tobacco plants set out by a machine June 6th. Each plat contained six rows, three and one-fourth feet apart, with twenty inches space between plants in the row.

The cutworms were somewhat troublesome, particularly on Plats 8, 9, 10, causing a resetting of many plants. Most of the plants were topped July 23d. The crop on all plats was cut and housed August 17th and 18th. All plats suffered somewhat from a serious drought.

NUMBER OF PLANTS HARVESTED PER PLAT, 1894.

Plat 1,	685.	Plat 6,	673.
Plat 2,	672.	Plat 7,	684.
Plat 3,	678.	Plat 8,	695.
Plat 4,	667.	Plat 9,	640.
Plat 5,	635.	Plat 10,	672.

REPORT OF COMMITTEE ON CROP, 1894.

Rank of Plats.

Texture, color, vein, Plats 10, 3, 7, 2, 4, 8, 9, 6, 1, 5.

Total weight of tobacco, Plats 8, 7, 4, 6, 3, 10, 2, 1, 9, 5.

Percentage of wrappers, Plats 2, 4, 3, 8, 7, 1, 9, 10, 6, 5.

ACTUAL YIELD PER PLAT. (POUNDS.)

Plats.	Weight of tobacco.	Weight of wrappers.	Percentage of wrappers.
8	132	68	51.51
7	130	72.5	55.77
4	128	79.5	62.11
6	125	65	52.00
3	123	74	60.16
10	117.5	62.5	53.10
2	107	44.5	41.60
1	106	45.5	42.92
9	101.5	56.5	55.66
5	80	39	48.75

QUALITY OF ASH AND FIRE HOLDING CAPACITY. (FIRST YEAR.)

Quality of ash.	Fire holding capacity.	
	According to plats.	
Plats.	Plat.	Seconds.
10	1	3
4	2	4
1	3	11
2	4	15
8	5	5.5
5	6	12
9	7	18
6	8	6.5
3	9	6.5
7	10	6

Second Year. (1895.) The management of the second year's experiment was essentially the same as in the preceding year, as far as arrangement of plats and kind and amount of fertilizer was concerned. The tobacco plants were set out June 11. The cut worms were troublesome making the tobacco uneven in growth, although the different plats averaged about alike in that respect. The crop was cut and housed August 26th.

NUMBER OF PLANTS HARVESTED PER PLAT.

Plat 1,	(record lost.)	Plat 6,	(record lost.)
Plat 2,	585.	Plat 7,	605.
Plat 3,	600.	Plat 8,	605.
Plat 4,	615.	Plat 9,	565.
Plat 5,	580.	Plat 10,	590.

REPORT OF COMMITTEE ON CROPS, 1895.

Rank of Plats.

Texture, color, vein, Plats, 3, 4, 2, 10, 6, 9, 7, 8, 1, 5.

Total weight of tobacco, Plats, 3, 4, 7, 8, 2, 6, 9, 10, 1, 5.

Percentage of wrappers, Plats, 2, 4, 3, 8, 7, 1, 9, 10, 6, 5.

ACTUAL YIELD PER PLAT. (POUNDS.)

Plats.	Weight of tobacco.	Weight of wrappers.	Percentage of wrappers.
3	147	39	26.53
4	147	45.5	30.95
7	145	37	25.60
8	142.5	37.5	26.31
2	141	48	34.04
6	141	16	11.35
9	138	24	17.39
10	134.5	17.5	13.01
1	129	26	20.15
5	94	6	6.39

QUALITY OF ASH AND FIRE HOLDING CAPACITY (SECOND YEAR).

No statement received.

Third Year (1896). The plats were prepared the same as in preceding years with the exception of plat 5, which had hitherto received no fertilizer whatever; 739 pounds of Canada wood ashes were applied to the plat. The plants were set June 9th, they subsequently suffered somewhat from the cutworms. The tobacco was cut and housed August 25th.

NUMBER OF PLANTS HARVESTED PER PLAT.

Plat 1,	677	Plat 6,	682
Plat 2,	692	Plat 7,	696
Plat 3,	705	Plat 8,	701
Plat 4,	688	Plat 9,	685
Plat 5,	684	Plat 10,	681

REPORT OF COMMITTEE ON CROP (1896.)

Rank of Plats.

Texture, color, vein, Plats 4, 9, 2, 8, 10, 6, 7, 5, 1, 3.

Total weight of tobacco, Plats, 8, 2, 3, 4, 6, 1, 10, 9, 7, 5.

Percentage of wrapper, Plats, 8, 6, 10, 4, 9, 3, 2, 7, 5, 1.

The entire crop was pronounced by the committee of inspection, to be, with the exception of the samples from plats 5, 1, 3, a first class article, as far as dark as well as light shades were concerned.

ACTUAL YIELD PER PLAT. (POUNDS, 1896.)

Plats.	Weight of tobacco.	Weight of wrappers.	Percentage of wrappers.
1	141.5	83.5	59.01
2	147.5	99.5	67.45
3	145.	98.	67.58
4	143.	101.	70.63
5	100.5	61.5	61.19
6	141.5	111.5	78.79
7	133.	83.5	62.78
8	152.	126.	82.89
9	134.5	95.	70.63
10	135.	100.	74.07

QUALITY OF ASH AND FIRE HOLDING CAPACITY. WESTFIELD, 1896.

Quality of ash.	Fire holding capacity.	
	According to plats.	
Plats.	Plats.	Seconds.
4	1	12.5
9	2	7.0
10	3	8.0
3	4	14.0
5	5	30.2
6	6	12.5
8	7	6.6
7	8	22.4
2	9	20.1
1	10	15.5

ANALYSIS OF TOBACCO. WESTFIELD 1896.

(Whole Leaf.)

	1	2	3	4	5	6	7	8	9	10
Moisture,	10.42	6.28	9.75	14.71	9.85	8.89	10.53	10.60	9.58	10.10
Nitrogen,	2.29	2.70	3.22	2.74	2.22	3.01	2.47	2.68	2.79	3.28
Phosphoric acid,	.52	.49	.51	.46	.53	.49	.50	.43	.47	.50
Sulphuric acid,	1.38	1.76	1.30	.86	1.30	1.69	1.70	1.55	.91	.97
Chlorine,	.256	.036	.074	.203	.118	.202	.124	.153	.059	.292
Potassium oxide,	5.06	4.98	4.92	4.99	5.10	5.47	5.09	4.88	4.37	4.59
Sodium oxide,	2.89	2.96	2.93	2.79	2.24	2.03	2.20	2.48	2.16	2.61
Calcium oxide,	5.90	5.06	4.88	5.35	5.46	4.70	4.86	6.82	6.54	5.40
Magnesium oxide,	1.20	1.61	1.65	1.62	.94	1.02	.95	1.13	1.26	1.63
Ferric & Al. oxide,	.50	.95	.32	.55	.88	.87	.87	.63	.48	.74
Total ash as sulphates	30.72	30.33	27.03	29.73	29.08	28.09	28.97	30.40	29.64	28.83
Sulphuric acid in total ash, less sulphuric acid in plant,	14.17	14.56	13.68	15.04	13.63	12.85	13.26	13.31	15.43	14.32
Silicious material insoluble in diluted hydrochloric acid,	1.97	1.72	1.27	1.92	2.49	1.96	1.91	2.06	2.00	.012

Total ash has been determined as sulphates instead of carbonates for reason stated.

R. H. SMITH, Analyst.

SUMMARY OF TOBACCO EXPERIMENT. WESTFIELD.

Number of plants harvested, weight of tobacco per plat, and weight of tobacco per 1000 plants.

	Number of plants per plat.			Weight of tobacco per plat.			Weight of tobacco per 1000 plants.		
	1894	1895	1896	1894	1895	1896	1894	1895	1896
Plat 1,	685	593	677	106	129	141.5	154.8	217.4	209.0
Plat 2,	672	585	692	107	141	147.5	159.3	239.3	213.2
Plat 3,	678	600	705	123	147	145	181.4	245.0	205.8
Plat 4,	667	615	688	128	147	143	192.0	229.0	207.8
Plat 5,	635	580	684	80	94	100.5	126.0	162.0	147.0
Plat 6,	673	594	682	125	141	141.5	185.7	237.3	207.4
Plat 7,	684	605	696	130	145	133	190.1	239.6	191.1
Plat 8,	695	605	701	132	142.5	152	190.0	235.5	216.8
Plat 9,	640	565	685	101.5	138	134.5	158.6	244.2	196.6
Plat 10,	672	590	681	117.5	134.5	135	174.9	228.0	198.2

SUMMARY OF YIELD OF TOBACCO AND PERCENT OF WRAPPER PER
1000 PLANTS. WESTFIELD.

	Tobacco total yield (lbs.)			Wrapper total yield (lbs.)			Per cent of wrapper.		
	1894	1895	1896	1894	1895	1896	1894	1895	1896
Plat 1,	154.8	217.4	209.	66.4	43.8	123.3	42.90	20.15	59.00
Plat 2,	159.3	239.3	213.2	65.5	81.4	143.8	41.60	34.40	67.45
Plat 3,	181.4	245.—	205.8	109.2	65.0	139.1	60.20	26.50	67.80
Plat 4,	192.0	239.—	207.8	119.2	74.	146.7	62.10	30.95	70.63
Plat 5,	126.0	162.—	147.0	61.4	10.4	80.0	48.7	6.39	61.19
Plat 6,	185.7	237.3	207.4	96.6	26.9	163.4	52.0	11.35	78.79
Plat 7,	190.1	239.6	191.1	106.	61.1	120.	55.70	25.60	62.78
Plat 8,	190.0	235.5	216.8	98.	61.9	179.6	51.60	26.31	82.89
Plat 9,	158.6	244.2	196.6	88.2	42.5	138.8	55.60	17.39	70.63
Plat 10,	174.9	228.	198.2	93.	29.5	147.	53.20	13.01	74.70

V. SUMMARY OF THREE YEARS OF OBSERVATION AT HATFIELD, AGAWAM
AND WESTFIELD.

1. *Number of Plants Harvested and Yield of Tobacco per One
Thousand Plants.*

HATFIELD (*Old tobacco land*).

Year.	Average number of plants.		Difference in yield per plat on the basis of 1000 plants.	
	Per plat.	Per acre.	Highest.	Lowest.
1893	561	6734	266 lbs.	217 lbs.
1894	618	7419	223 "	191 "
1895	626	7512	222 "	191 "

WESTFIELD (*New tobacco land*).

1894	670	8040	192 lbs.	155 "
1895	593	7122	245 "	217 "
1896	689	8269	216 "	191 "

AGAWAM (*New tobacco land*).

1893	696	8352	225 lbs.	158 lbs.
1894	704	8432	220 "	164 "
1895	695	8340	222 "	148 "

2. *Average Yield of Tobacco on the Basis of One Thousand Plants
Harvested.*

Year.	Hatfield.	Westfield.	Agawam.
1893	235.2	—	191.3
1894	206.4	171.6	186.7
1895	210.5	228	176.2
1896	—	199.4	—

3. *Average Yield of Tobacco, with reference to Wrapper, per One Thousand Plants.*

HATFIELD.

Year.	Average yield of tobacco.	Average yield of wrapper.	Average percentage of wrappers.	Variation in percentage of wrappers in plats.
1893	235.2	97.21	41.2	21 -71
1894	206.6	105	50 7	38.8-64.4
1895	210.1	109.3	52.1	36.8-63.1.

AGAWAM.

Year.	Average yield of tobacco.	Average yield of wrappers.	Percentage of Wrappers	Variation in percentage of wrappers.
1893	190.8	Not determined.	Not determined.	Not determined.
1894	191.7	52.5	26.7	8.8-44.4
1895	178.8	Not determined.	Not determined.	Not determined.

WESTFIELD.

Year.	Average yield of tobacco.	Average yield of wrappers.	Percentage of Wrappers	Variation in percentage of wrappers.
1894	171.3	90.3	52.3	41.6-62.10
1895	228.7	49.6	21.2	6.4-34.40
1896	199.3	138.2	69.6	59-78.8

4. *Conclusions Drawn from the Third Year of Observation.*

1. Good mechanical preparation of the soil and early application and thus good diffusion of the fertilizers, not less than early planting and a suitable number of plants to a given area, exert a decided influence on the quantity and the quality of the crop under other otherwise corresponding conditions. Planting as early as the local climate admits secures the benefit of the winter moisture. Too close planting interferes with a liberal or rapid development of the leaves, and too large open spaces between the individual plants tends to favor a coarser structure. Rows three feet and four inches apart with plants twenty inches from each other in the row (Westfield) and rows two feet and eight inches apart with plants two feet from each other in the row (Hatfield) gave better returns than rows three feet apart with plants eighteen inches from each other in the row (Agawam).

2. A timely *shallow* use of the cultivator or the hoe for the removal of weeds favors a uniform progress of growth. A careless use of cultivator or hoe invariably checks more or less the growth of the plants and modifies more or less their structure and general character.

3. The different fertilizer mixtures used in our experiments have affected in a less marked degree the weight of the crop raised by their aid than the quality. New lands reduced by previous cropping to a state approaching general exhaustion of available plant food—if otherwise well fitted for raising tobacco—have given excellent results when supplied with a suitable mixture of fertilizing ingredients in quantities similar to those applied during our experiments (Westfield.) Such lands are at times preferable to old tobacco lands overcharged with remnants of all kinds of saline ingredients usually associated with the common run of commercial fertilizers.

4. Cotton-seed meal, linseed meal, and castor pomace have proved equally good sources of nitrogen, for the successful raising of tobacco, when used in connection with nitrate of soda or potash, sufficient to furnish one fourth of the nitrogen called for by the crop.

5. Nitrate of soda as part of the nitrogen supply of the fertilizer (25%) when used in presence of acid phosphate or dissolved bone-black, etc., has been accompanied with better results regarding quality of crop than nitrate of potash under otherwise similar conditions.

6. Cotton seed hull ashes and high grade sulphate of potash have proved in our observation most valuable sources of potash for tobacco, the former in the majority of cases leading. Nitrate of potash has produced excellent results when used in connection with an alkaline phosphate as phosphatic slag meal or with carbonate of potash-magnesia. Our results with potash-magnesia sulphate as main potash sources of a tobacco fertilizer are not encouraging.

7. The difference noticed in the color of ash, etc., in case of the crop being raised upon different plats is in several instances so slight that any attempt at classifying the various fertilizers used with reference to their superior fitness cannot be otherwise than somewhat arbitrary. With this qualification in mind, the following classification is offered for the consideration of parties engaged in the cultivation of tobacco in our section of the country :

First class	{	Plat 4—Nitrate of soda, cotton seed hull ashes, castor pomace.
		“ 3— “ “ “ “ “ cotton seed meal.
		“ 9—Nitrate of potash, cotton seed hull ashes, cotton seed meal.
		“ 10—Nitrate of potash, carbonate of potash-magnesia, phosphatic slag.
Second class	{	Plat 6—Nitrate of soda, high grade sulphate of potash, cotton seed meal, dissolved bone black.
		“ 8—Nitrate of soda, high grade sulphate of potash, linseed meal, dissolved bone black.
		“ 7—Nitrate of soda, high grade sulphate of potash, castor pomace, dissolved bone black.
Third class	{	Plat 1—Nitrate of potash, potash-magnesia sulphate, cotton seed meal, dissolved bone black.
		“ 2—Nitrate of potash, potash-magnesia sulphate, castor pomace, dissolved bone black.

The observations with barnyard manure have not been considered in the above classification; they are very encouraging yet not sufficient in number to advise detailed discussion in this connection. Besides, the amount of barnyard manure used in our experiment, 10 tons per acre, contained nearly two hundred pounds of potassium oxide and from thirty to forty pounds of available phosphoric acid less than our formula of commercial fertilizing ingredients called for. An early application of barnyard manure properly supplemented with a suitable potash compound and available phosphoric acid has produced excellent results in other localities.

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